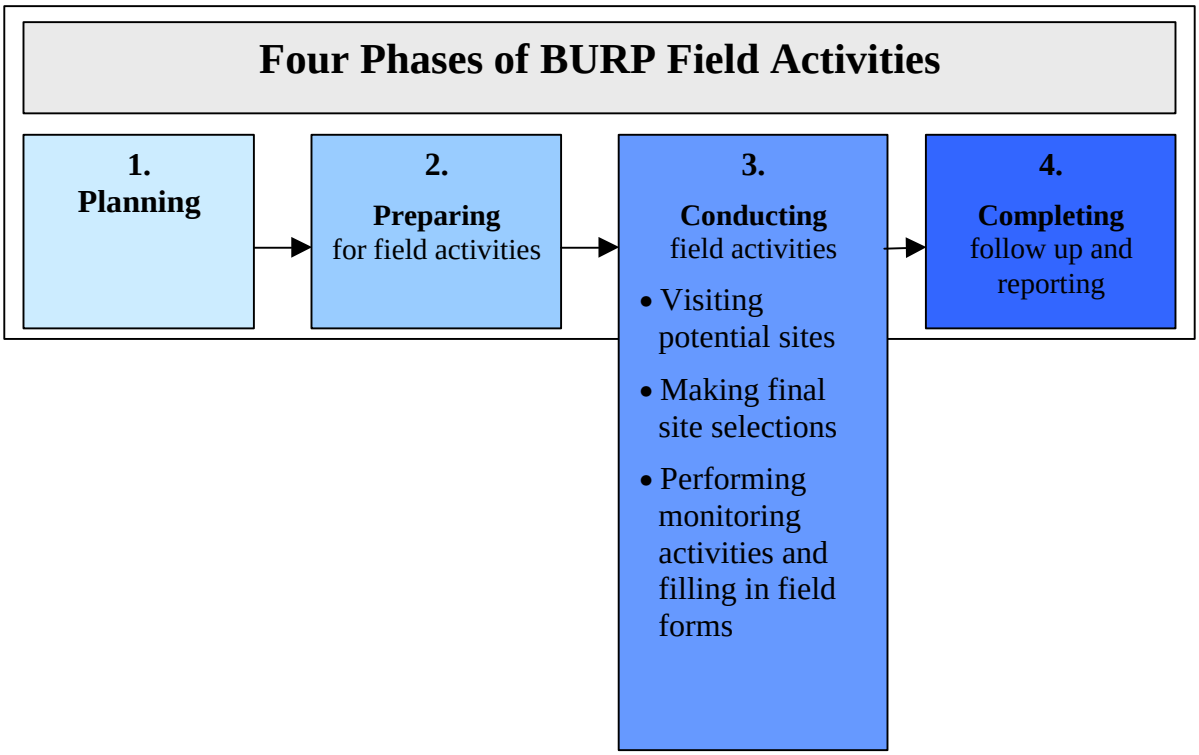
3 Conducting BURP Field Activities

Conducting field activities includes visiting pre-selected sites and either verifying or changing site selections, performing monitoring activities and filling in field forms. These steps are shown in the Conducting box shown in Figure 10 and are detailed below.

Figure 10. Steps in the Conducting Field Activities phase.



3.1 Visiting Potential Sites

If a potential site is privately owned and permission to access it was granted more than two days ago, the landowner or representative should be contacted again to remind him or her of the planned visit and to confirm that you have permission. The BURP Coordinator will usually make this contact.

When accessing a site, always leave each gate as it was (open if it was open; closed if it was closed). Avoid livestock and on-site facilities whenever possible. If at all possible, avoid driving across soft terrain, as that often leaves damaging vehicle tracks. When placing site markers such as ribbons or stakes, note their locations so they can be removed when monitoring is complete.

3.2 Make Final Site Selections

Sampling sites pre-selected in the planning phase now have to be confirmed or changed. Upon reaching a site, ensure that it meets the water body size criteria for streams (see section 1.3.3) and that it is representative of the reach or entire stream (see section 1.4.1). If a pre-selected site is not appropriate, relocate to a more representative location. If a pre-selected site is not sampleable, follow the protocols in section 1.4.3. Mark the location of the site finally selected on the map created during the site pre-selection process (see section 1.4.2) and include the map and site selection document in the site file. Check.

3.3 Performing Monitoring Activities in the Field

Following the sequence below (illustrated in Figure 11 and outlined on the following two pages) is an efficient way to conduct a BURP survey. However, this sequence may be adjusted to meet the needs of individual crews. The illustration in Figure 11 shows the general layout of a typical BURP reach and indicates where within the reach each variable should be measured.

3.3.1 Recommended Sequence

1. Determine the appropriate reach for surveying. The length should be 30 times the general bankfull width or a minimum of 100 meters.

2. Measure the appropriate distance and mark beginning and ending points with flagging, being careful to stay out of the stream. The downstream end of the measured length is considered the beginning of the reach.

3. Take photographs of the site and record Photo Information on the Habitat Distribution and Photo Data page (see section 3.3.11.2).

4. Record global positioning system (GPS) coordinates and map location on the Site Identification page (see section 3.3.4.7). Mark the location on the map.

5. Fill out the information about the Location Relative to Landmark (see section 3.3.4.12) on the Site Identification page.

6. Complete the bacteria screening process (see section 3.3.15.1).

7. Collect bacteria samples if the screening process indicates it is necessary and the schedule can accommodate the sample holding time (30 hours) (see section 3.3.15.2).

8. Measure specific conductivity and temperature (see sections 3.3.4.10 and 3.3.5.9) and record them on the General Stream Data page.

9. Measure stream discharge in a location with a relatively straight channel and uniform flow, where possible (see section 3.3.12), and record on the Discharge Measurement page.

10. Locate the first riffle upstream from the beginning point and establish the first transect (T1). At T1, perform the following:
    a. Collect a macroinvertebrate sample (see section 3.3.6.1).
    b. Collect a periphyton sample (see section 3.3.6.2).
    c. Measure canopy closure (shade) (see section 3.3.8.2) and record on the Width, Depth, Canopy, Banks Data page.
    d. Conduct a pebble count immediately upstream from T1. Record the pebble count on the Substrate Data page (see section 3.3.7.1).

11. Go 10 meters above T1 and perform the following:
    a. Measure width and depth of the stream, and record on the Width, Depth, Canopy, Banks Data page (see section 3.3.8.1).
    b. Measure undercut banks if they are present, and record on the Width, Depth, Canopy, Banks Data page (see section 3.3.8.4).
    c. Measure canopy closure again, and record only in the Comments section on the Comments page. This additional canopy closure measurement is part of a pilot project and is not recorded in the main data sections of the field forms.

12. Proceed to a mid-site riffle habitat unit and establish the second transect (T2). Repeat macroinvertebrate collection, periphyton collection, pebble count, and canopy closure measurements and record on the appropriate pages of the field forms (see 10a–10d above).

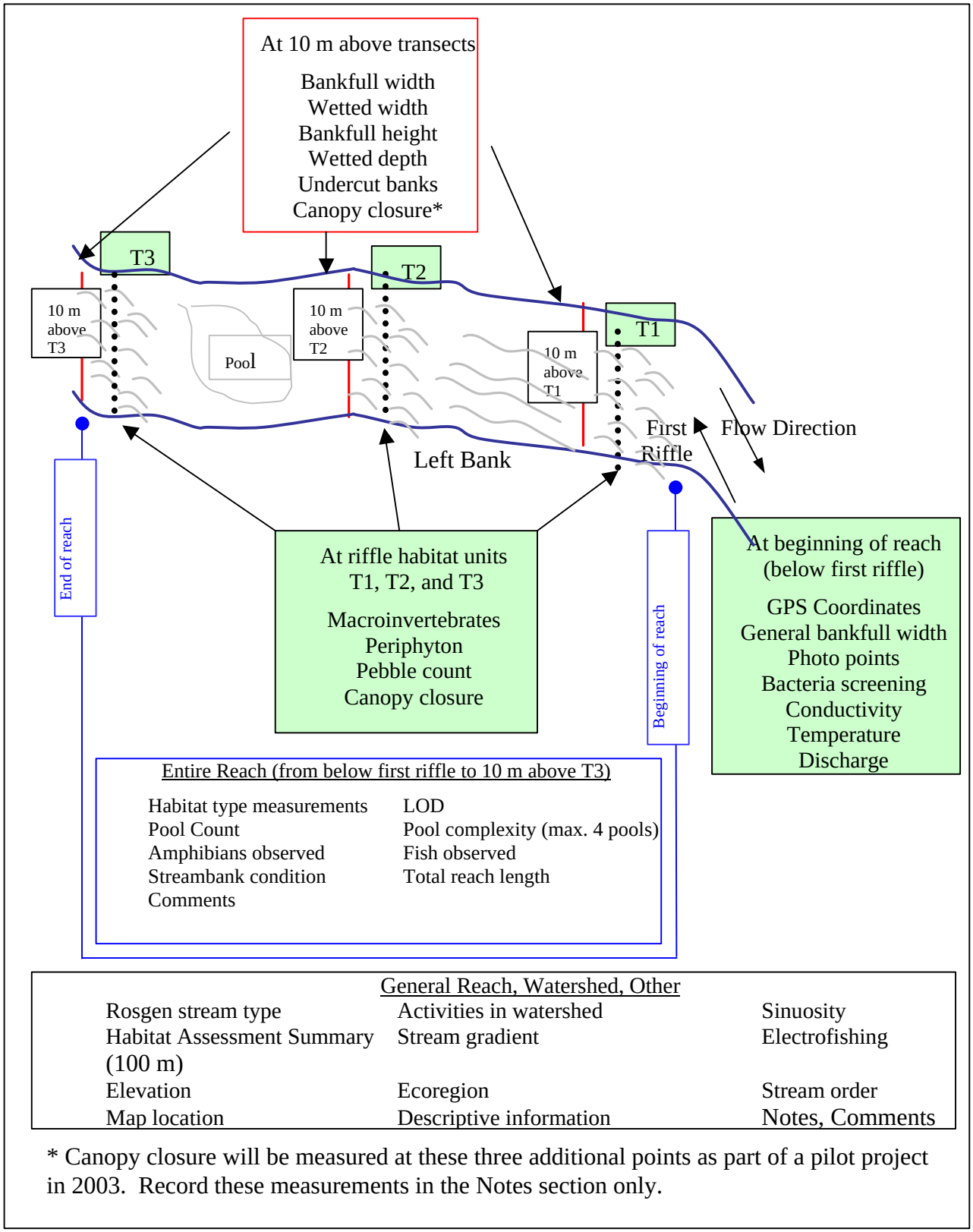
13. Go 10 meters above T2 and repeat width, depth, and any undercut banks measurements and record on the Width, Depth, Canopy, Banks Data page.

14. Measure canopy closure 10 meters above T2 and record only in the Comments section on the Comments page. This additional measurement is part of a pilot project and is not recorded in the main data sections of the field forms.

15. Proceed to an upper-site riffle habitat unit and establish the third transect (T3). Repeat macroinvertebrate collection, periphyton collection, pebble count, and canopy closure measurements and record on the appropriate pages of the field forms.

16. Go 10 meters above T3 and repeat width, depth, and any undercut banks measurements and record on the Width, Depth, Canopy, Banks Data page

17. Also measure canopy closure 10 meters above T3 and record only in the Comments section on the Comments page. This additional measurement is part of a pilot project and is not recorded in the main data sections of the field forms.



* Canopy closure will be measured at these three additional points as part of a pilot project in 2003. Record these measurements in the Notes section only.

Figure 11. A typical BURP reach, showing where each variable is measured.

18. Perform the following reach-wide measurements simultaneously as you move back down the reach. (In some cases, you may choose to do them as you work your way up the reach. This will usually be when the terrain is difficult, allowing you to move through the reach just once.)
    a. Conduct longitudinal habitat distribution measurements by characterizing and measuring pools, riffles, runs, and glides. (Hawkins et al. [1993] is helpful for making these distinctions.) Record on the Habitat Distribution and Photo Data page (see section 3.3.11.1). Calculate the total reach length and record it on the General Stream Data page (see section 3.3.5.2).
    b. Count large organic debris (LOD) (see section 3.3.10.2) and record on the Streambank Condition, LOD, Habitat Assessment Data page.
    c. Assess pool complexity at a minimum of three pools within the site. Follow the pool definition given as one of the habitat types (see section 3.3.11.1) to identify pools. Record on the Pools Data page. Also count the total number of pools throughout the reach and record on the Pools Data Page.
    d. Conduct a streambank condition (bank stability) survey by rating the amount of cover and stability of each bank (see section 3.3.10.1). Express this as percent of total length surveyed on the Streambank Condition, LOD, Habitat Assessment Data page.

19. When all other activities are completed, gather the crew and complete the Habitat Assessment Summary (see section 3.3.10.3) on the Streambank Condition, LOD, Habitat Assessment Data page.

20. Conduct fish sampling if it is to be done, using electrofishing (see section 3.3.14). Make note of fish and amphibians observed on the Biological Data page (see sections 3.3.6.3 and 3.3.6.4), even if none are collected or vouchered any.

21. Determine and record stream gradient (see section 3.3.5.3), Rosgen stream type (see section 3.3.4.4), stream order (see section 3.3.5.6), sinuosity (see section 3.3.5.7), and activities in the watershed (see section 3.3.5.8).

22. Decontaminate equipment and gear before leaving the site (see section 4.1.1).

23. Leave the site as it was (see section 4.2.1).

24. Contact the landowner (if possible) to thank her for allowing you access and to let her know you are finished and are leaving the site (see section 4.2.2).

3.3.2 Filling in and Handling BURP Field Forms

The BURP field forms are teleforms designed to be read by an electronic reader. They are reviewed in the regional office and then submitted to the state office for input to the BURP database. For both efficiency and data quality control, certain rules must be followed when filling out and handling these forms. The general rules, that apply to all forms, are listed below. Rules that apply only to individual fields are discussed in those sections.

3.3.2.1 General Rules for Filling In and Handling BURP Field Forms

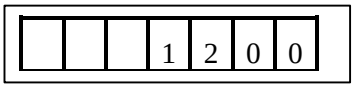
- Print legibly.
- Use a number 2 pencil.
- Fill in the Site ID on **all** pages (lower left corner).
- All alpha characters must be capital letters.
- Each cell must contain only one character.
- Keep all parts of each character, whether letter or numeral, entirely inside the box or cell.
- Do **not** put slashes through zeroes, sevens, or any other characters.
- Fill in or darken circles (radio buttons). They must be at least 80% filled. Do not put a check mark, X, or other mark in or through any circle.
- If the wrong circle is filled in by mistake, fill in the correct circle as well and circle it. Transcribe the form (make a new one that is correct) in the regional office before submitting it to the database manager in the state office.
- Do not spill anything on the forms. The electronic reader will try to interpret spots and blotches as data. This will slow down the process and might create quality control issues.

  Do not staple the pages. This creates marks or tears that cause problems with electronic readability.
- Ensure that the corner markers (four right angles, one in each corner of the page) stay intact (i.e., don't let corners of forms get torn or crumpled). The electronic reader has to "sight" all four corner markers to read the page correctly.
- Ensure that the "bar code" number (this is simply a 10-digit number, not a scanable bar code like those used in stores) in the upper left hand corner stays intact (i.e., don't let it get torn, crumpled, or marked). This is the key to accessing the form for reading the data.
- Print comments in the Comments section only (Page 10), not in the margins or anywhere else on the forms.

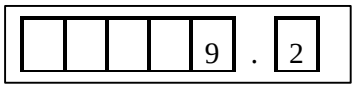
The following terms will be used in the rules given for individual fields on the field form pages:

- *Left Justified*
  Data begins in
  the left-most cells
  as shown

- *Right Justified*
  Data uses only the right-most cells as shown



- *Decimal Justified*
  Data is supplied in appropriate cells, with decimal pre-filled. Preceding zeroes are not required.



3.3.3 Data Fields on the BURP Field Forms

The next twelve subsections of this manual correspond to the ten pages of field forms, plus the fish data sheets and bacteria screening checklist. Each subsection begins with a sample of how a page of the field forms looks when it is filled in properly, displayed as a figure. This is followed by a discussion of each variable on that page, which may include a definition of the variable and a rationale for including it in BURP monitoring. The method or protocol used to measure or determine each variable is then described.

3.3.4 Site Identification Page

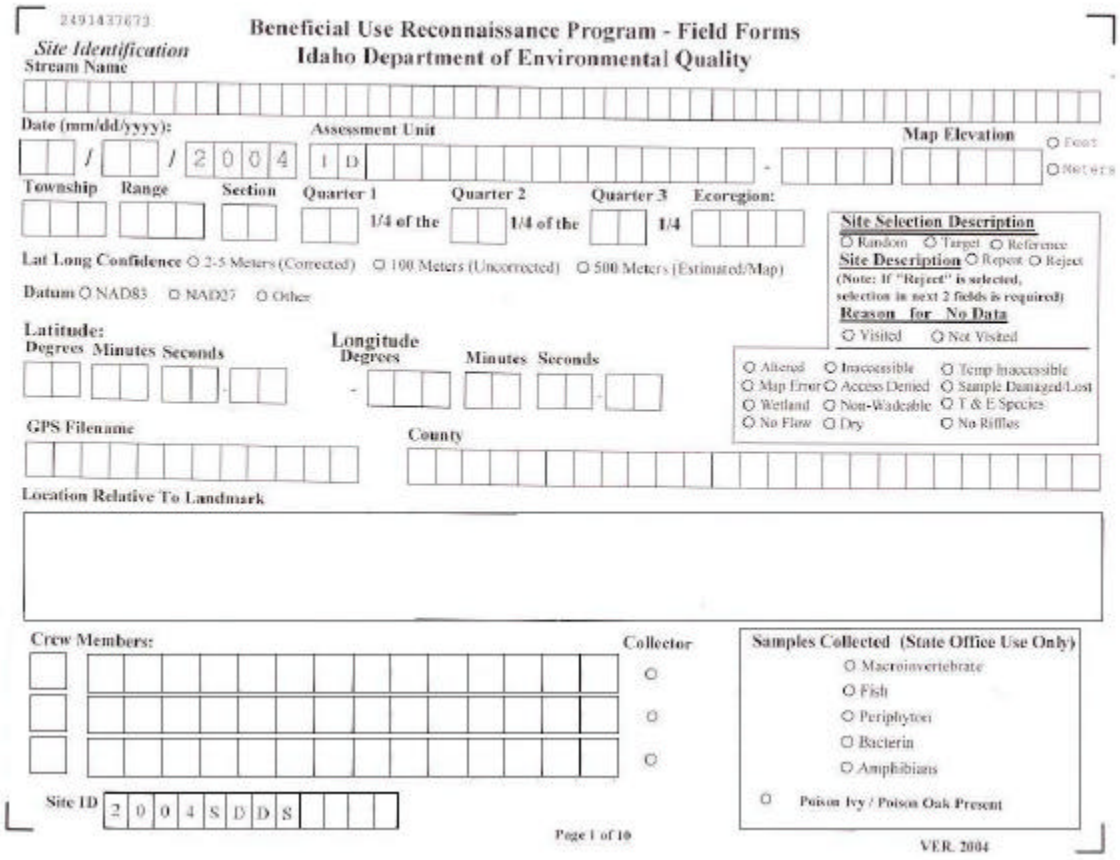


Figure 12. Site Identification page example.

3.3.4.1 Stream Name

It is critical that the correct name and location of the stream being monitored be consistently used (Meixler 1999). Different sources will often have different spellings for the same stream. Also, there can be many streams using the same name. For instance, there are 46 Bear Creeks and Rock Creeks in Idaho (U.S. Geological Survey 2000). BURP has adopted the USGS Geographic Names Information System (GNIS) (U.S. Geological Survey 2000) as the standard source for stream names for Idaho. Look up each stream name in the GNIS and verify the location and spelling. Use the properly spelled name on all BURP field forms, field notes, and labels concerning a particular monitoring site.

This is a left justified alphanumeric field. Leave unused cells blank

3.3.4.2 Date

The date format is YYYY/MM/DD, representing year, month, and day. As an example, July 21, 2003 is written as 2003/ 07/21. Fill all cells.

3.3.4.3 Hydrologic Unit Code (HUC)

This comes from a stream numbering system comprising the USGS 4th field hydrologic unit codes (HUCs). These numbers can be obtained from a GIS coverage or HUC map.

3.3.4.4 Assessment Unit (AU)

This is a left justified alphanumeric field. Leave unused cells blank.
The format is ID + HUC + Basin + Water Body ID _ + stream order (example below)

I	D	1	7	0	4	0	2	1	4	S	K	0	1	3		-	0	2		

- First two cells: the state code ("ID" for Idaho) is pre-printed on the form.
- Next eight cells: Fourth field HUC code. Use only numeric characters.
- Next two cells: Basin Code (example "SK" for Snake River Basin; see other codes below). Use only alpha characters.

  Basin codes:

  BR = Bear Basin (HUCs begin 1602 or 1601)

  CL = Clearwater Basin (HUCs begin 1706...)

  PN = Panhandle Basin (HUCs begin 1701...)

  SL = Salmon Basin (HUCs begin 1706...)

  SW = Southwest Basin (HUCs begin 1705...)

  SK = Snake River Basin (HUCs begin 1704...)

- Next four cells: Water Body ID. Use only numeric characters for the first three of these four cells; the fourth cell is for an optional* alpha character.
- One underscore/dash place holder is supplied.
- Next four cells: Stream Order Code. The first two of these four cells are mandatory numeric; the last two of these four cells are for optional* alpha characters.

*If the optional alpha character cells are not needed leave them blank as shown in the example above.

The AU is assigned by DEQ. If this is not already filled in on the field form, contact your BURP Coordinator. Based on latitude and longitude information, the AU can be filled in when the GIS shapefile is downloaded.

3.3.4.5 Map Elevation

Elevation is the height above or below sea level at a given point on the earth's surface, obtained from, or as depicted by, a topographical map. Identify elevation using a 1:24,000 topographic map, **not** a GPS unit.
This field is right justified. Leave unused cells blank. Designate feet or meters for units.

3.3.4.6 Public Land Survey Coordinates

Find public land survey coordinates on a 1:100,000 scale map and record them on the field form in the following order: township, range, section, quarter 1, quarter 2, and quarter 3 (quarter 1 on the field form is the smallest quarter on the map).

The diagram in Figure 13 shows an example of public land survey coordinates. A township is a division of territory in surveys of U.S. land containing 36 sections (36 square miles). A range is one of the north-south rows of townships in a U.S. public-land survey. Ranges are numbered east and west from the principal meridian of the survey. A section is a piece of land one square mile in area forming one of the 36 subdivisions of a township. Sections are divided into quarters. Quarters are further divided into smaller quarters.

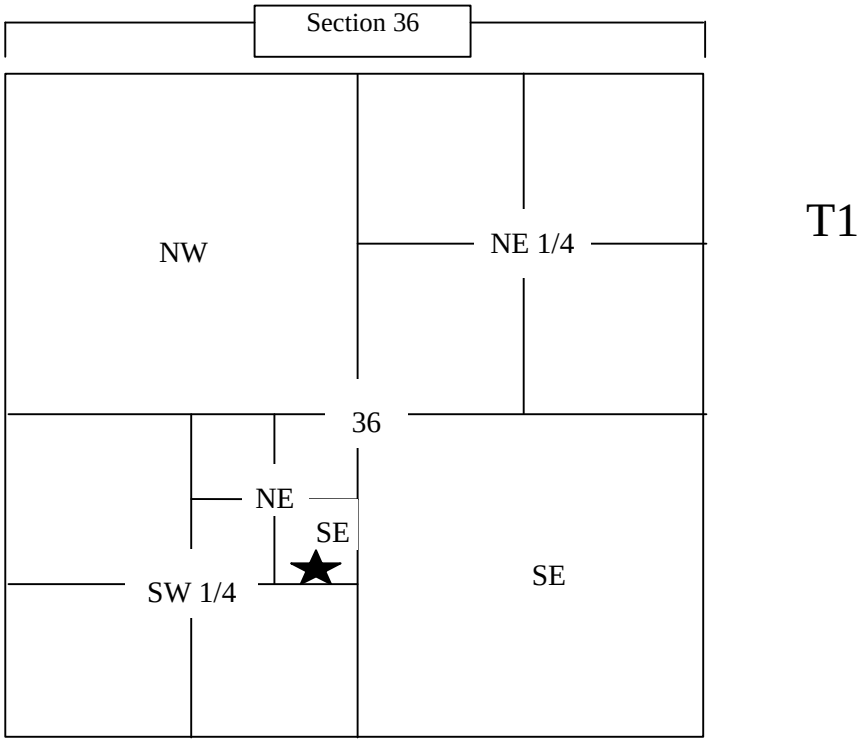


Figure 13. Example of public land survey coordinates.

3.3.4.7 Latitude and Longitude

Latitude and longitude are obtained from a GPS instrument. If the instrument is unable to get a reading, these coordinates can be simply appended to the final shape file in ArcView® or within the GPS file. Leave numbers initially written down uncorrected.
This is a decimal justified field.

3.3.4.8 Latitude Longitude Confidence

If the latitude and longitude have been differentially corrected, fill in the circle for 2-5 meters. If the data have not been differentially corrected, fill in the circle for 100 meters. If the GPS cannot get a reading, fill in the circle for 500 meters (estimate) indicating the values are derived from a map. All GPS instruments used for BURP surveys should be programmed for using NAD27 Datum. There may be unusual circumstances when other datums are necessary, in which case the BURP Coordinator will notify you of this change. Unless notified differently, fill in the circle for NAD27 on the field form.

3.3.4.9 GPS Filename

A GPS file name is required to identify the particular site. Use the default name provided by the GIS unit, assign a file name, or choose the site identification number from the data dictionary in the GIS unit. Use the same site identification number as on the field forms.

3.3.4.10 County

Record the county the site is located in.

3.3.4.11 Ecoregion

Ecoregions are areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. They are designed to serve as a spatial framework for the research, assessment, management, and monitoring of ecosystems and ecosystem components.

Identify the ecoregion the site is located within from an appropriate ecoregion map. Figure 14 is an example of a Level III ecoregion map for Idaho (McGrath et al. 2001).Figure 15 is an example of a Level IV ecoregion map.

Ecoregional boundaries are represented by lines on a map; however, these boundary lines may represent gradational changes rather than sharp changes in ecology. When a sample site is near an ecoregional boundary line, evaluate the ecoregion at the site rather than assigning the ecoregion strictly by boundary lines indicated on the map.

This field is left justified. Use alpha or numeric characters. Leave last cells blank if there are no data for them.

3.3.4.12 Location Relative to Landmark

Provide a site description based on permanent landmarks, such as roads, tributaries, and prominent features. The description should be sufficient for a return trip by someone who was not present on the initial trip.
This is a memo field; print legibly.

3.3.4.13 Crew Members

Record only the first initial (no period) and last name of each crew member, such as "S Woodhead." Fill in the circle next to the name of the crew member acting as collector for this site. The collector is the crew member responsible for collecting the macroinvertebrate and periphyton samples.

3.3.4.14 Samples Collected

Fill in the circle for each type of sample collected during the site visit.

3.3.4.15 Site ID (site identification)

Each site has its own unique site identification number. For example, for site 2002SLEWA001, 2002 represents the year, S means stream, LEW identifies the regional office, A identifies the "A" crew, and 001 are the numbers unique to the site. The next site that crew monitors will have its identification number ending with 002, followed by 003, and so on.

The site ID must be recorded on each individual field sheet.

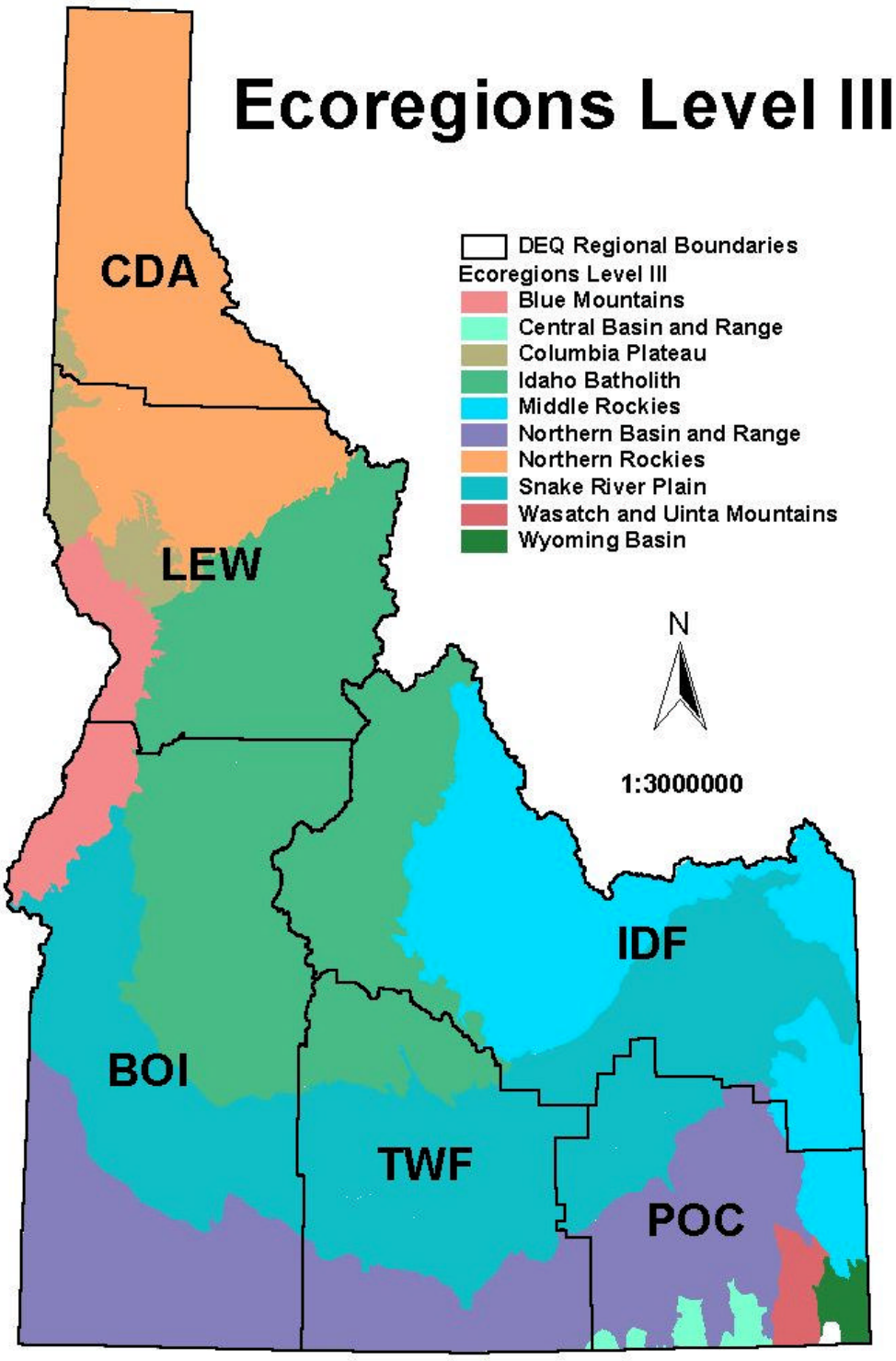


Figure 14. Example of a Level III ecoregion map for Idaho

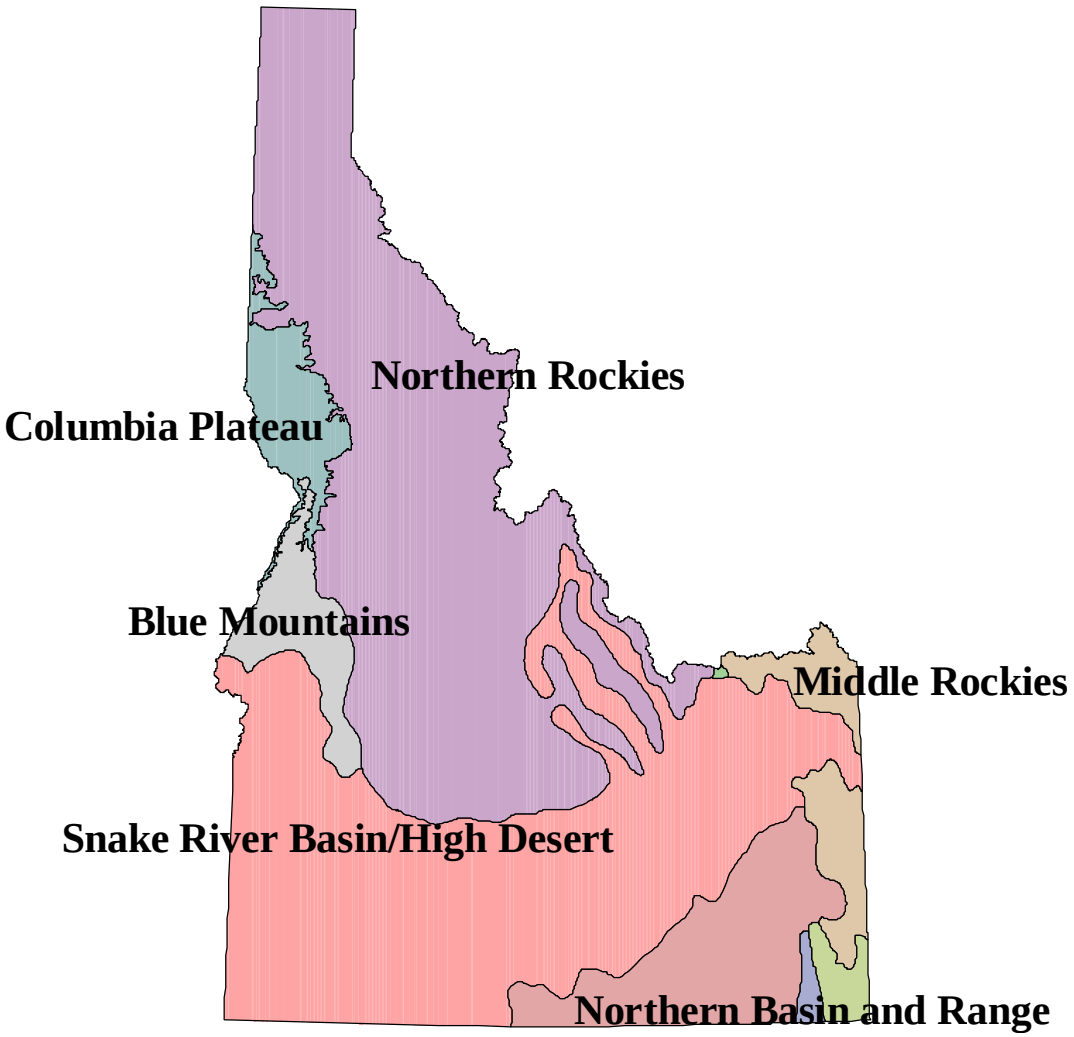


Figure 15. Example of a Level IV ecoregion map for Idaho.

3.3.5 General Stream Data Page

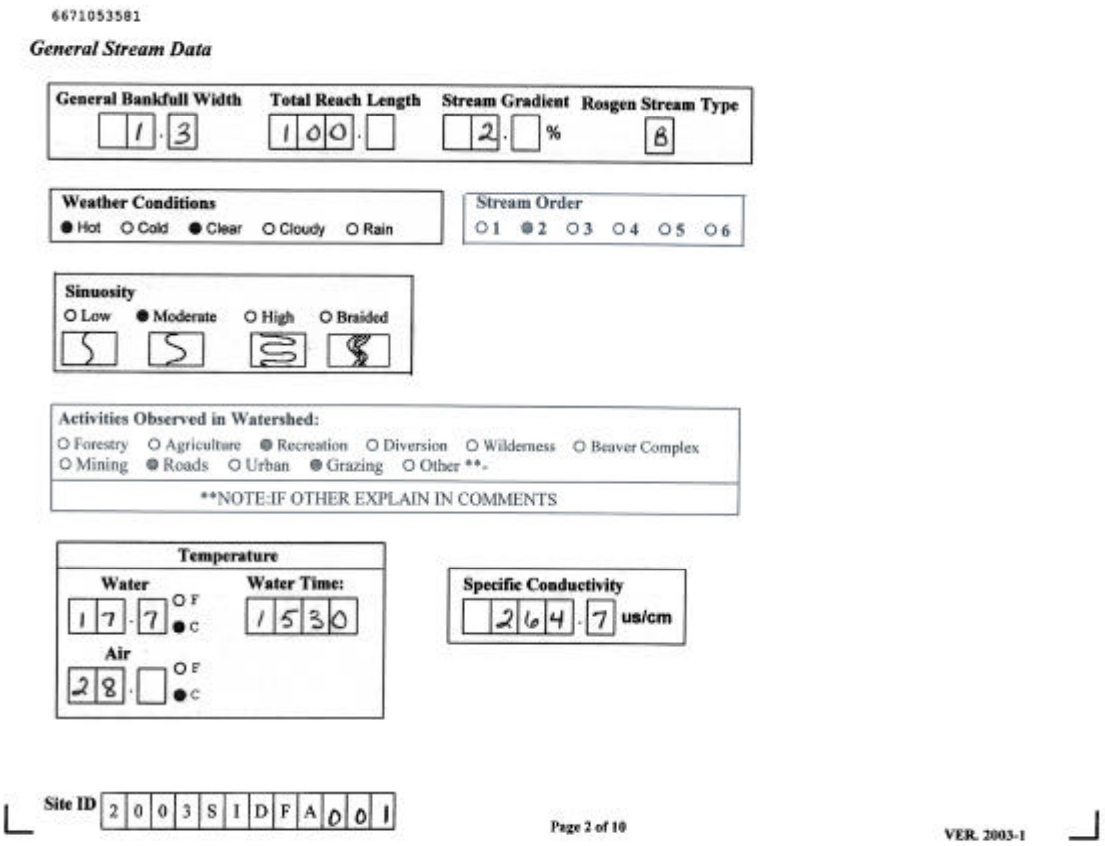


Figure 16. General Stream Data page example.

3.3.5.1 General Bankfull Width

The general bankfull width is the average channel width between the tops of the most pronounced banks on either side of a stream reach. Take several measurements, calculate the average, and record it on the field form. For further discussion regarding bankfull width, see section 3.3.8.1, Width/Depth Ratio, and Leopold et al. (1995).

This is a decimal justified field.

3.3.5.2 Total Reach Length

The total reach length is calculated as the sum of the individual lengths of segments classified as riffles, runs, pools, and glides. When initially laying out the reach, the length must be either 30 times the general bankfull width or a minimum of 100 meters, whichever is greater.

This is a decimal justified field.

3.3.5.3 Stream Gradient

BURP uses gradient as a measurement of the slope of the water's surface. Stand so that the bottom of your feet are level with the water's edge. Measure the gradient with a clinometer sighted as far upstream or downstream as feasible at an object the same height (your eye level) as the clinometer. Often two people work together: one holds a horizontal two-meter rod held at the sighter's eye level, while the second person sights on the rod with the clinometer. Alternatively, use the clinometer to sight on a ribbon tied at eye level upstream or downstream. If the distances are relatively short, take three readings and average them.

This is a decimal justified field.

3.3.5.4 Rosgen Stream Type

Under this system, streams are grouped according to geomorphic structure, water source, associated biota, or other characteristics.

Streams in Idaho exhibit considerable variability in climates, hydrology, geology, land forms, and soils. Recognizing this, the BURP Technical Advisory Committee elected to use Rosgen's (1996) Stream Classification System, Level I, to potentially characterize streams for comparison. As Conquest et al. (1993) noted, "One way to organize an inherently variable landscape is to employ a system of classification. The general intent of the classification is to arrange units into meaningful groups in order to simplify sampling procedures and management strategies."

Determine the Rosgen stream type to Level I only. First determine the following:

- amount of erosion
- amount of deposition
- channel shape (see cross-sectional view from DEQ flip chart)
- gradient
- sinuosity
- width/depth ratio

Compare this information with the illustrations in Figure 17 and the corresponding descriptions in Table 3 to help determine Rosgen stream type.

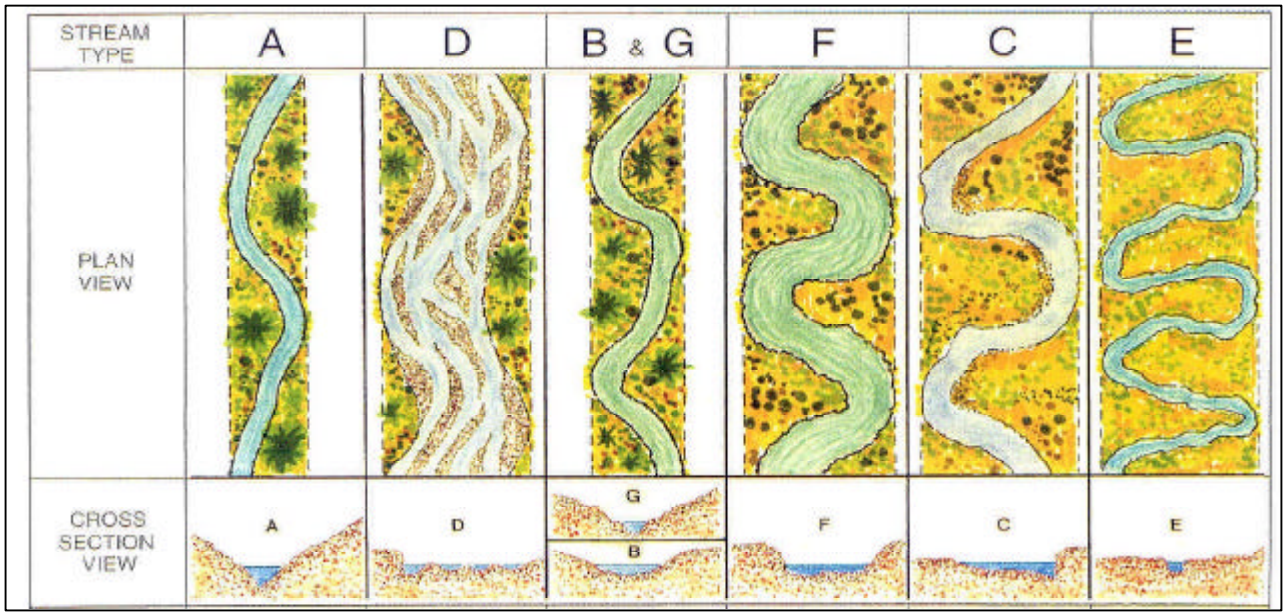


Figure 17. Rosgen Stream Type illustrations and descriptions.

(Rosgen Stream Type Illustrations and Descriptions adapted from Rosgen 1996, used with permission).

Table 3. Description of Rosgen Stream Types.

Rosgen Stream Type	A	D	B and G	F	C	E
Gradient	4-10%	<4%	2-4%	<2%	<2%	<2%
Description	Steep, entrenched, cascading, step/pool streams. High energy debris transport associated with depositional soils. Very stable if bedrock- or boulder-dominated channel.	Braided channel with longitudinal and transverse bars. Very wide channel with eroding banks.	B channel: moderately entrenched, moderate gradient, riffle dominated, with infrequently spaced pools. Very stable banks. G channel: entrenched "gully" step/pool and low width/depth ratio on moderate gradient.	Entrenched, meandering, riffle/pool channel on low gradients with high width/depth ratio.	Low gradient, meandering, point-bar, riffle/pool, alluvial channel with broad, well defined flood plain.	Low gradient, meandering riffle/pool stream with low width/depth ratio and little deposition. Very efficient and stable. High meander width ratio.

3.3.5.5 Weather Conditions

Fill in the circle for any of the conditions existing during the site visit. If none apply, do not mark any. This is a multiple selection field; more than one circle can be marked.

3.3.5.6 Stream Order

Stream order is a hierarchical ordering of streams based on the degree of branching. As shown in Figure 18, a first-order stream is an unforked or unbranched stream. Two first-order streams flow together to form a second-order stream, two second-order streams combine to make a third-order stream, etc. Use a 1:100,000 map to determine stream order. This is a single selection field, choose only one.

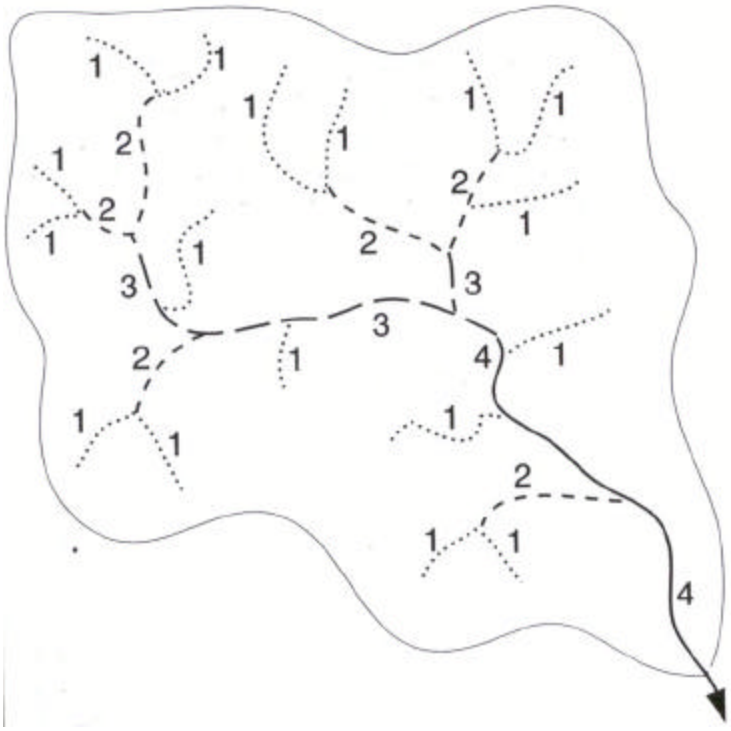


Figure 18. Stream orders.

3.3.5.7 Sinuosity

Sinuosity is the ratio between channel length between two points in a channel and the straight line length between the same two points.
Channels with sinuosities of 1.5 or more are called “meandering,” while those close to 1.0 are called “straight.”

This is a single selection field, only choose one.

3.3.5.8 Activities Observed in Watershed

Fill in the circle for any of the listed activities observed in the watershed and give additional information on the Comments page of the field forms. This is a multiple selection field; more than one activity can be selected.

3.3.5.9 Temperature

Zaroban (2000) pointed out that a number of factors influence water temperatures in streams. Stream water temperatures are influenced by water source, ground water, precipitation runoff, solar radiation (including shading), air temperature, climate, and geologic setting (Stevens et al. 1975). These factors must be considered in the design of any water temperature study, placement of temperature sensing devices, and interpretation of temperature data. Methods to help standardize surface water temperature monitoring and reduce sampling variability have been recommended (Stevens et al. 1975, Essig 1998, Water Quality Interagency Workgroup for the Oregon Plan 1998). Essig (1998) summarized a close relationship between air and stream temperature shown by several scientists[1]. Consequently, DEQ collects both air and water temperature data.

Water

Take the water temperature in a shaded spot in the stream using a calibrated thermometer. Be sure the water is adequately mixed and not influenced by localized warm or cool water sources such as ground water, point sources, or direct sunlight. Shaded sites with moderately turbulent flows, such as the tailouts of lateral scour and plunge pools, are good locations. Leave the thermometer in the water several minutes until it stabilizes before you take a reading.
This is a decimal justified field. Fill in the circle indicating whether the reading is Celsius or Fahrenheit (Celsius is preferred).

Water Time

Record the time the water temperature was taken in military time (i.e., 1:00 pm is 1300).

Air

Using a calibrated thermometer, take the air temperature at the bottom of the reach in the riparian zone. The thermometer should be placed in the shade about one meter high. Use either a hand-held thermometer or the temperature sensor on a specific conductivity or dissolved oxygen meter. Take the air temperature first while the thermometer is dry.

This is a decimal justified field. Fill in the circle indicating whether the reading is Celsius or Fahrenheit.

[1] Essig (1998) summarized what several scientists have shown to be a close relationship between air and stream temperature, citing Collins (1925), Mangan (1946), Moore (1967), Smith and Lavis (1975), Smith (1981), Crisp and Howson (1982), and Sinokrot and Stefan (1994).

3.3.5.10 Specific Conductivity

Conductivity is defined as a measure of the ability of a solution to carry an electrical current (Armantrout 1998). Conductivity is measured as micromhos per centimeter (µmhos/cm) or microsiemens per centimeter (Armantrout 1998).

Conductivity is dependent on the total concentration of ionized substances dissolved in the water. Elements whose ionic forms contribute the most to these measures include calcium, magnesium, sodium, potassium, bicarbonate, sulfate, and chloride. Solutions of most inorganic compounds are relatively good conductors. Conversely, molecules of organic compounds that do not dissociate in aqueous solution conduct a current very poorly, if at all (Franson 1998).

Several sources discuss the usefulness of conductivity data. Kunkle et al. (1987) found conductivity to be an useful indicator of mining and agricultural effects. Royer and Minshall (1996) found sites designated as degraded generally had higher conductivity values. Maret et al. (1997) reported conductivity is one environmental factor determining the distribution of fishes. Davis et al. (2001) report that conductance is an important water quality measure because the data can be used to estimate the total dissolved solids in the water. The conductivity of the water is important to electrofishing efforts (Reynolds 1983, 2000; Kolz 1993). Reynolds (1983) notes that a freshwater conductivity range of 100-500 µmhos/cm is best for electrofishing.

The conductivity of potable waters in the United States ranges generally from 50 to 1,500 µmhos/cm (Franson 1998). Hem (1985) reports the range of conductance values for natural ground and surface waters range from 50 µmhos/cm to 50,000 µmhos/cm or more. Values of 2 to 41 µmhos/cm have been reported for melted snow in the western United States (Hem 1985).

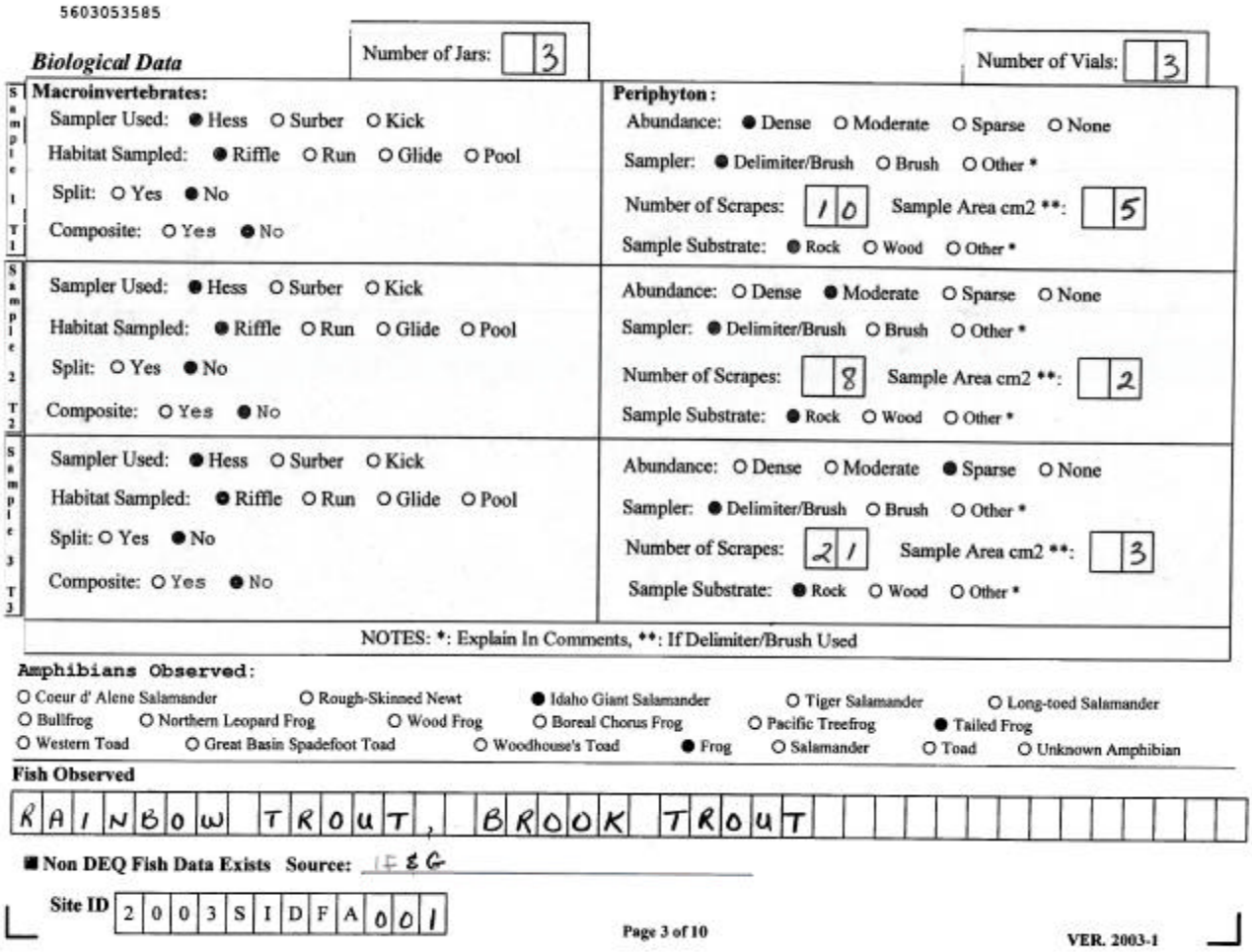
Before measuring conductivity, ensure that the meter is clean, in good working condition, and calibrated. Always transport the instrument in a protective carrying case. Use fresh batteries and carry a spare set of batteries and/or a backup meter. Keep a log book with the meter and record all calibrations, maintenance, and repairs. Follow the manufacturer's recommendations concerning cleaning and storing the meter.

Measure conductivity at T1 using a calibrated conductivity-temperature meter. Calibrate the instrument using a calibration solution within the same range of conductivity as the streams being monitored.

Place the meter in flowing water at mid depth. If using the YSI model 30, be sure the "ºC" indicator on the machine **is blinking**, indicating the instrument is measuring specific conductivity. Specific conductivity must be measured in the field (Radtke et al. 1998) to be reliable. For in situ measurements, which are recommended, immerse the conductivity and temperature sensors in the water a minimum of one minute to allow the sensors to equilibrate to water conditions. Record the conductivity (in microsiemens per centimeter at 25 °C) and temperature on the field form without removing the sensors from the water. Record conductivity measurements to three significant figures and use whole numbers only. This is a decimal justified field.

Rinse the sensor in deionized water and store it properly.

3.3.6 Biological Data Page



5603053585

Biological Data Number of Jars: 3 Number of Vials: 3

Sample 1 T1
Macroinvertebrates:
Sampler Used: ● Hess ○ Surber ○ Kick
Habitat Sampled: ● Riffle ○ Run ○ Glide ○ Pool
Split: ○ Yes ● No
Composite: ○ Yes ● No

Periphyton:
Abundance: ● Dense ○ Moderate ○ Sparse ○ None
Sampler: ● Delimiter/Brush ○ Brush ○ Other *
Number of Scrapes: 10 Sample Area cm2 **: 5
Sample Substrate: ● Rock ○ Wood ○ Other *

Sample 2 T2
Sampler Used: ● Hess ○ Surber ○ Kick
Habitat Sampled: ● Riffle ○ Run ○ Glide ○ Pool
Split: ○ Yes ● No
Composite: ○ Yes ● No

Abundance: ○ Dense ● Moderate ○ Sparse ○ None
Sampler: ● Delimiter/Brush ○ Brush ○ Other *
Number of Scrapes: 8 Sample Area cm2 **: 2
Sample Substrate: ● Rock ○ Wood ○ Other *

Sample 3 T3
Sampler Used: ● Hess ○ Surber ○ Kick
Habitat Sampled: ● Riffle ○ Run ○ Glide ○ Pool
Split: ○ Yes ● No
Composite: ○ Yes ● No

Abundance: ○ Dense ○ Moderate ● Sparse ○ None
Sampler: ● Delimiter/Brush ○ Brush ○ Other *
Number of Scrapes: 21 Sample Area cm2 **: 3
Sample Substrate: ● Rock ○ Wood ○ Other *

NOTES: *: Explain In Comments, **: If Delimiter/Brush Used

Amphibians Observed:
○ Coeur d' Alene Salamander ○ Rough-Skinned Newt ● Idaho Giant Salamander ○ Tiger Salamander ○ Long-toed Salamander
○ Bullfrog ○ Northern Leopard Frog ○ Wood Frog ○ Boreal Chorus Frog ○ Pacific Treefrog ● Tailed Frog
○ Western Toad ○ Great Basin Spadefoot Toad ○ Woodhouse's Toad ● Frog ○ Salamander ○ Toad ○ Unknown Amphibian

Fish Observed
RAINBOW TROUT, BROOK TROUT

■ **Non DEQ Fish Data Exists Source:** IDFG

Site ID 2003SIDFA001

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Figure 19. Biological Data page example.

3.3.6.1 Macroinvertebrates

A macroinvertebrate is an animal without a backbone large enough to be seen without magnification and to be retained by a screen with 0.595-mm mesh (U.S. #30) (Armantrout, 1998).

Sampling for macroinvertebrates is an essential part of the BURP process. This biological assemblage reflects the overall ecological integrity of a stream. Because most streams are monitored infrequently, chemical monitoring is not always representative of the long-term condition of the stream. The biological community is exposed to the stream's condition over a long period of time, and therefore provides an integrated representation of water conditions and better classification of support status. Macroinvertebrates are an useful assessment tool because

they are ubiquitous, include numerous species, and respond to physical and chemical impacts in the water column (Rosenberg and Resh 1993). Additionally, macroinvertebrates with certain environmental tolerances may provide some insight regarding pollutants (Johnson et al. 1993).

BURP collects macroinvertebrate samples from three separate riffle habitat units (T1, T2, and T3) spread evenly through the reach, following Clark and Maret (1993). In a typical BURP survey, the person who collects macroinvertebrates also collects periphyton either before or immediately after collecting the macroinvertebrates.

To collect macroinvertebrates at each transect (T1, T2, and T3), first randomly select a location for macroinvertebrate sampling by generating two random numbers and using one as the lateral distance along the streambank to go upstream and the other as the perpendicular distance to go out across the stream. Place the sampler in this location. If the randomly chosen site does not provide an adequate seal or sample, move the sampler as much as one meter in any direction to improve sample collection.

Using a sampler (Hess is preferred but other types may be used) with a 500-micron size net (Hayslip 1993, Barbour et al. 1999), collect a macroinvertebrate sample. Brush all rocks and stir the substrate for a minimum of two minutes. Strive for a consistent time of three to five minutes per sample. Place the scrubbed rocks in front of the sampler net. Stir the substrate to a depth of 10 cm with a metal rod. Take care not to damage the macroinvertebrates during all phases of sample collection. Handle all macroinvertebrate samples (in the field) over a white pan, including transferring the sample from the net to the sample container. If any of the sample gets into the white pan, wash it into the sample bottle with ethyl alcohol (ETOH). (See Appendix D for a material safety data sheet [MSDS] for ethyl alcohol.)

Place the sample into a container, label it inside and out, and preserve with no less than 95% ethanol (the container should be filled to the shoulder). If a container is greater than 50% full of sample material, the contents should be divided into two containers (a split sample). If a single sample is divided into more than one container, be sure the sample labels and field data forms clearly reflect the sample identity. If more than one container is used, **each label** must state which container this is out of how many total—for example: 1 of 3, 2 of 3, and 3 of 3. As a minimum, each label must contain 1) stream name, 2) date, 3) site ID, 4) collector's name, and 5) jar count (e.g., 1 of 3, 2 of 3). After closing each sample container, gently invert it to mix the sample with the alcohol. Repeat this collection procedure at T2 and T3.

On the field form, fill in the total number of sample jars for the site (a right justified field), the type of sampler used, the habitat sampled, and whether the sample was split or composited (entire sample in one jar). Sampler Used, Habitat Sampled, Split, and Composite are single selection fields; choose only one in each field.
After sampling the reach, thoroughly rinse all brushes, nets, and other items that have come in contact with the sample. Examine them carefully and remove any algae or other debris. Examine all equipment again before using it at the next BURP site and reclean it if necessary to avoid sample contamination.

For the sample labels, use archival grade heavy paper that can withstand storage in alcohol (such as Resistall Paper 36#). Use an alcohol-proof ink pen or pencil for writing the field information on the label. Put one label inside the jar in addition to taping a label to the outside of the jar. After they have been identified and returned to DEQ, BURP specimens are deposited in the Orma J. Smith Museum of Natural History, Albertson College of Idaho, Caldwell. These specimens are then available for any later verification that might be needed and for future research opportunities.

3.3.6.2 Periphyton

Periphyton is attached microflora growing on the bottom of the stream or on other submerged substrates, including higher plants.

Periphyton is an useful indicator because of its wide distribution, numerous species, and rapid response to disturbance (Barbour et al. 1999). Periphyton integrates physical and chemical impacts because it exists in the water column. Diatoms, a type of periphyton, have frequently been identified as useful biological indicators, particularly in Montana, Kentucky, Oklahoma, and European countries (Round 1991, Rosen 1995). Periphyton information supplements fish and macroinvertebrate information because of differences in trophic levels, motility, and life history (Allen 1995). Additionally, if current fish information is unavailable for a particular stream, there will still be data from two other biological assemblages (if both periphyton and macroinvertebrates are collected) to determine aquatic life support status.

Collect periphyton samples from three separate riffle habitats (T1, T2, and T3), just above where the sampler was placed. Use a modified 30-cc syringe and a small, stiff-bristled brush. Randomly choose a stone from the wetted stream channel and carry it to the bank, making sure that the portion of the stone that was exposed to the sun remains on top. If no stone is available, use a piece of submerged wood, debris, or other hard surface. Firmly press the modified syringe over the stone and add a small amount of water using an aspirator or eye dropper. Place the brush into the syringe and scrub the surface of the stone until the attached algae are loose. When the algae have been sufficiently dislodged from the rock, use the aspirator to remove the mixture and place it into a 50-ml scintillation vial. Fill the vial to 40 mL and preserve by filling the remainder of the vial with 10% formalin to a volume of 50 mLs.

In a typical BURP survey, the person who collects macroinvertebrates also collects periphyton either before or immediately after collecting the macroinvertebrates

Combine the samples from all three riffles into a composite sample. If the periphyton are sparse, scrape the rock more than once to collect an adequate sample. Be sure to note the number of scrapes on the field form and, if necessary, separate the composite sample into two or more containers. Also note the abundance and type of substrate. If the substrate was something other than rock or wood, fill in the circle for “other,” and describe in the Comments section. Number of Vials, Number of Scrapes, and Sample Area are right justified fields, for numeric characters only. Abundance, Sampler, and Sample Substrate are single selection fields; choose only one in each field.
Ensure that 1% of the total sample volume is preserved with 10% formalin. (see Appendix D for an MSDS for formalin, and Appendix E for additional formalin handling information).

Labels must include, at a minimum: 1) stream name, 2) site ID, 3) date, 4) collector's name, and 5) vial count (e.g., 1 of 3, 2 of 3).

Label all sample containers (centrifuge tubes/vials) with labels printed on archival grade heavy paper that can withstand storage in formalin solution (such as Resistall Paper 36#), using an alcohol-proof ink pen or pencil to write on the label. Tape a label to the outside of the vial.

When the monitoring season is over, send all periphyton samples to the Water Quality Division in the DEQ state office (currently, to Cyndi Grafe).

3.3.6.3 Amphibians Observed

An amphibian is:

1) A cold-blooded, smooth-skinned vertebrate of the class Amphibia, such as a frog or salamander, that characteristically hatches as an aquatic larva with gills. The larva then transforms into an adult having air breathing lungs (Horton 2001).

2) An animal capable of living both on land and in water (Horton 2001).

Amphibians are in apparent decline (Corn 1994, Heyer et al. 1994, Mattoon 2000, Reaser 2000, Thomas 2001) and may be important water quality indicators (Heyer et al. 1994). For these reasons, BURP keeps records of amphibians observed at monitoring sites.

Fill in appropriate circles for amphibians observed within the survey area[2]. This is a multiple selection field, choose all that apply. It is recommended that a separate log of all amphibians observed be kept that includes species, numbers, and whether they are adult or juvenile. Any observations of amphibian deformities should be recorded in the Comments section of the field forms. Use DEQ's laminated ID flip charts to assist with identification.

Vouchering amphibians is optional[3]. It is recommended that a few voucher specimens of each taxon from each study site be collected to help DEQ verify the amphibian distribution in Idaho. Amphibians can be killed in weak ethyl alcohol solutions, in hot water. If these methods/agents are not available the amphibians can be killed in a 10% formalin solution. This can be done in an opaque plastic bottle. The specimens should be preserved in a 10% formalin solution. If the specimen is large, make a small incision in the body wall (ventral side) to allow for proper internal preservation. Later (in the museum) the specimens will be transferred into 70% ethyl alcohol.

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[2] Field identifications can be made using Peterson et al. (1996). Additional publications which help with the identification and distribution of amphibians in Idaho include Behler and King (1997), Fichter and Linder (1964), Linder and Fichter (1977), Nussbaum et al. (1983), and Stebbins (1985), Wilson (1975) and Groves et al. (1997). Several other guides to the amphibians of adjacent areas may prove useful and include Baxter and Stone (1985), Corkran and Thoms (1996), Koch and Peterson (1995), Leonard et al. (1993), and Reichel and Flath (1995).

[3] Recent publications concerning the sampling of amphibians include Corn and Bury, (1990), Bury and Corn (1991), Hyer et al. (1994), Olson et al. (1997), and Olson (1999).

Amphibian voucher specimens are deposited in the Orma J. Smith Museum of Natural History, Albertson College of Idaho, Caldwell. The information is shared with the Idaho Museum of Natural History, Idaho State University, Pocatello.

3.3.6.4 Fish Observed

Record all general fish observations. This is not a replacement for fish collection and identification discussed later in this manual. However, if fish collection is prohibited, noting your observations here is especially important.

Leave one blank cell for a space when there is more than one word in the species name (e.g., rainbow trout, brook trout). Put a comma in one cell and leave one cell blank between fish species. This is a left justified field, for alpha or numeric characters.

3.3.6.5 Non-DEQ Fish Data

This section is filled in by the BURP Coordinator or other office staff and is not related to field data.

3.3.7 Substrate Data Page

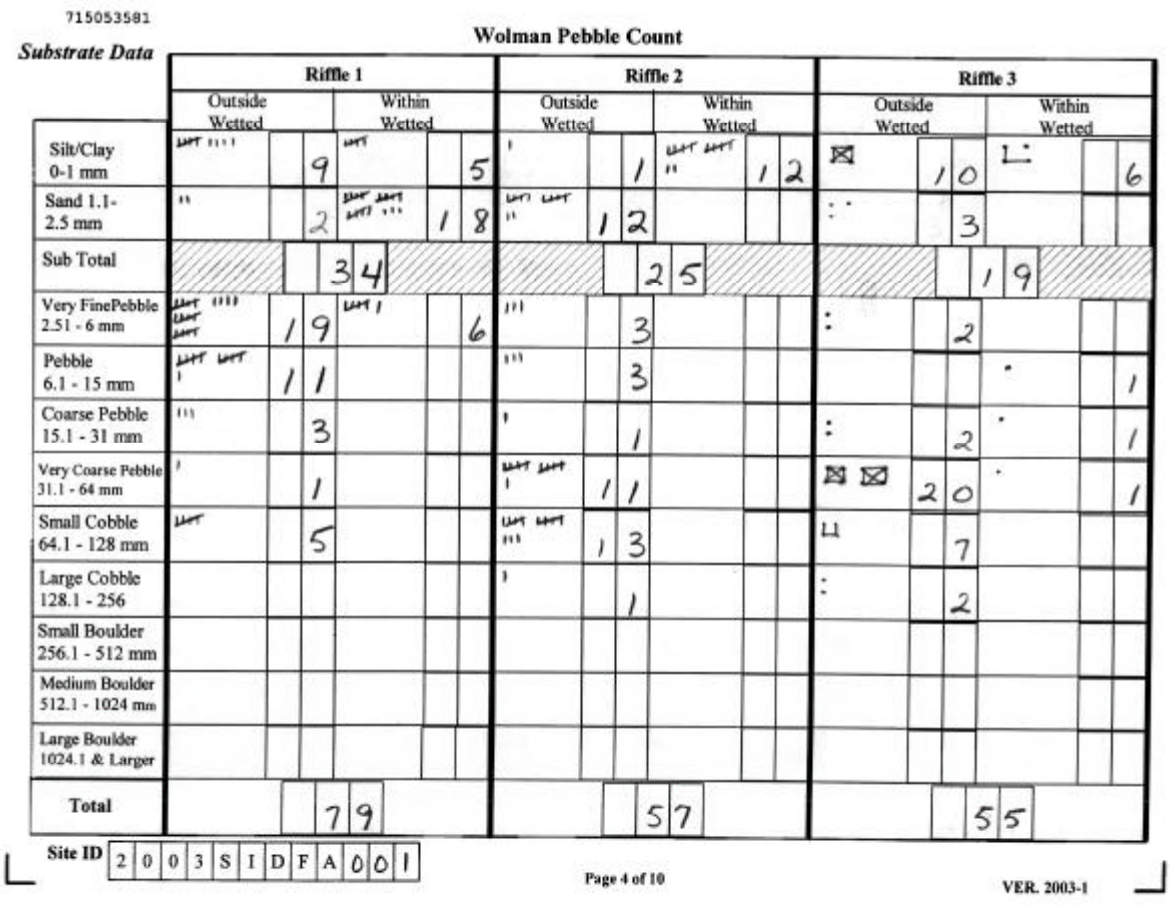

Figure 20. Substrate Data page example.

3.3.7.1 Pebble Count

The BURP process uses a modified Wolman Pebble Count (Wolman 1954) to quantify substrate size distribution in riffle habitats. This BURP pebble count method relies on surface fines, which are defined as material < 2.5 mm in diameter (Fore and Bollman 2002). These are used as a sediment metric in the Stream Habitat Index. Substrate is the mineral and organic material forming the bottom of a waterway or water body (Armantrout 1998). The stream substrate is the site of most biotic activity such as algae growth, insect growth and development, fish egg incubation, and small fish refuge (Davis et al 2001). Fine sediment and its accumulation can be detrimental to salmonid spawning (a beneficial use) since it may limit the quality and quantity of the inter-gravel spaces that are critical for egg incubation (Maret et al. 1993, Young et al. 1991, and Scrivener and Brownlee 1989). Several studies and state projects have found relative substrate size to be an important indicator of water quality effects due to activities in the watershed (Overton et al. 1993, McIntyre 1993b, Skille 1991).

Conduct pebble counts (substrate measurements) at the same three transects (T1, T2, and T3) in the riffle habitat units where macroinvertebrate and periphyton samples were collected. Work in undisturbed substrate above where those samples were collected, but within the riffle. If that is not possible, work within 1 meter below where the samples were collected, in undisturbed riffle substrate. Begin at the bankfull level on one streambank and proceed across the riffle to the bankfull level on the opposite streambank. Select pebbles at equidistant intervals (e.g., heel to toe, one pace, etc.). At each interval, reach to the stream bottom, pick up the first particle touched, and measure the intermediate axis. Record the particle size class and whether the particle was chosen from within or outside the wetted stream. Replace the particle downstream of the transect line. Disturb the bottom as little as possible. Measure a minimum of 50 particles per riffle for a total of 150 particles. Continue measuring and recording until the opposite streambank is reached, even if 50 pebbles have been counted before the transect is complete. Each successive pass must be upstream from the previous pass if multiple passes are required to reach the minimum 50 pebbles per riffle.

While counting, make tally marks (tick marks) in the appropriate tally area on the field form. Two different ways of making tally marks are shown on the example page in Figure 20: hash marks and dot-lines. When finished counting, add the tally marks and put the individual total for each field in the appropriate cell. The fields are right justified.

It is not necessary to fill in the fields labeled Subtotal (third line) and Total (last line), as the program will calculate these. However, you may fill them in if you want.

3.3.8 Width, Depth, Canopy, Banks Data Page

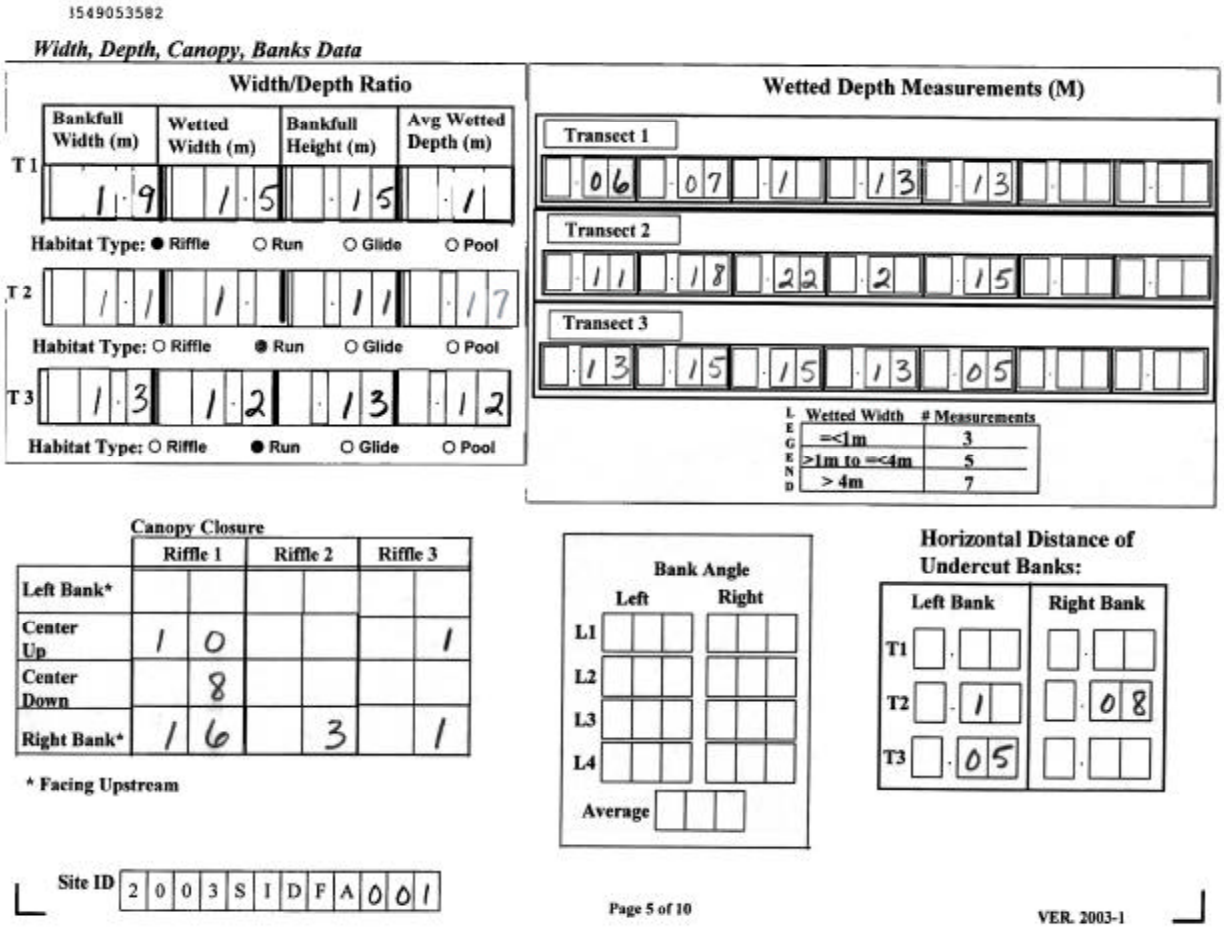

Figure 21. Width, Depth, Canopy, Banks Data page example.

3.3.8.1 Width/Depth Ratio

The width/depth ratio is defined as the ratio of the bankfull surface width to the mean depth of the bankfull channel (Rosgen 1996). DEQ also measures wetted width. The wetted width is the width of a water surface measured perpendicular to the direction of flow at a specific discharge. Widths of multiple channels are summed to represent the total wetted width.

The width/depth ratio is key to understanding the distribution of available energy within a channel and the ability of various discharges occurring within the channel to move sediment (Rosgen 1996). Rosgen (1996) also states that the width/depth ratio provides a rapid, visual assessment of channel stability. Further, the width/depth ratio is valuable in describing channel cross-section shape, and ratio values can be compared to interpret shifts in channel stability following disturbances to channels or watersheds (Rosgen 1996). Both depth and width can respond rapidly to changes in sediment load and/or discharge (Gordon et al. 1992, Overton et al. 1995). Width and depth measurements along with discharge data provide meaningful

information about stream size and habitat characteristics. These variables have significant impact on the distribution of the aquatic community. Further, grouping rivers by width and depth may be useful for data comparison purposes (Idaho Department of Health and Welfare 1996).

To collect width and depth measurements, first establish an additional transect 10 meters upstream from each riffle habitat unit transect (where macroinvertebrates and periphyton were collected). If necessary, take the third set of measurements outside the defined reach.

Conduct the procedure (detailed below) for measuring width and depth from the left bank to the right bank while facing upstream. Record width and depth measurements on the Width, Depth, Canopy, Banks Data page of the field forms. These are all decimal justified fields.

1. Measure bankfull width and height:

    - Stretch, secure, and level the tape across the bankfull width. Ensure the tape is perpendicular to the flow. Measure and record bankfull width.

    - Identify the bankfull stage, using, in part, Leopold et al. (1995).

    - Measure and record the bankfull height from the tape at bankfull elevation to the left wetted edge of the stream. Use the rating curve in Figure 22 to assist in identifying bankfull height. This rating curve is also illustrated in the DEQ flip charts.

2. Measure wetted width from the left to the right wetted edge of the stream.
3. Take wetted depth measurements:

    - Measure and record wetted depth measurements from the water surface to the channel bottom at evenly spaced intervals across the wetted width. Determine the number of intervals based on the wetted width of the stream. Use the following guideline to determine whether 3, 5, or 7 measurements are necessary (interval = wetted width divided by n+1):

Wetted Width	# Measurements (n)
$\leq$ 1 meter	3
> 1 but $\leq$ 4 meters	5
> 4 meters	7